

APPENDIX G

PRELIMINARY RISK ASSESSMENT

Technical Memorandum

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To: Forestry Compound – Pelham Range, Parcel 84(7), Fort McClellan
Preliminary Risk Assessment File

Date: 13 November 2001

Subject: **PRELIMINARY RISK ASSESSMENT FOR SUBJECT SITE**

This memorandum provides a Preliminary Risk Assessment (PRA) for exposure to surface or subsurface soil at the Forestry Compound. The PRA approach is a shortened version of the Streamlined Risk Assessment (SRA) protocol developed as a uniform and economical approach to evaluating hundreds of similar sites at Fort McClellan (FTMC). It is assumed that the reader is familiar with FTMC and the fundamentals of the SRA protocol. The reader is referred to the Installation-Wide Work Plan (IT, 1998) for more detail. All the comparison and computational operations of the PRA are performed within EXCEL[®] spread sheet tables. The results of each step are described below.

Media of Interest and Data Selection Data consist of 12 surface soil and 8 subsurface soil samples analyzed for metals, volatile organic compounds, semivolatile organic compounds, organochlorine pesticides and herbicides. The validated data are summarized by sample location in Tables 5-1 and 5-2 from the Site Investigation.

Site-Related Chemical Selection Site-related chemicals are those presumed to be released because of activities performed by the army during operation of FTMC. They are identified in Table 1 (surface soil) and Table 2 (subsurface soil) by comparing the maximum detected concentration (MDC) of each chemical with its background screening criterion (BSC), computed as two times the mean of the background data set, in accordance with EPA (2001) Region IV guidance. BSCs were taken from Tables 5-1 and 5-2. Upper tolerance limits (UTL), the highest metal concentrations reasonably considered to be within background, are also included in Tables 1 and 2 for information, but were not used to select site-related chemicals. The UTL provides a more refined statistical approach than the BSC for comparing site and background data. UTLs were developed for the entire FTMC facility, combining data from the Main Post and Pelham Range. The UTLs for total soil were adopted for subsurface soil.

Chemical of Potential Concern Selection Chemicals of potential concern (COPC) are site-related chemicals whose MDCs exceed their site-specific screening levels (SSSL), and which may contribute significantly to risk. The SSSLs are receptor-, medium-, and chemical-specific risk-based concentrations that capture all the exposure assumptions and toxicity assessment of a full-blown baseline risk assessment. COPCs are selected for both cancer risk and noncancer effects when the data permit (Tables 1 and 2).

Receptor Scenario Selection The proposed land reuse plan states that the Forestry Compound

will be used by the Alabama Army National Guard for training. The most plausible receptor is a National Guardsperson (Goetchius, 2001). An on-site resident is also included as the upper-bound evaluation on exposure and risk, and to provide additional perspective. SSSLs for both receptor scenarios were used for COPC selection and to characterize risk.

Risk Characterization Risk characterization combines the exposure assumptions and toxicity assessment (incorporated in the SSSLs) with the exposure-point concentration (EPC) to quantify the incremental lifetime cancer risk (ILCR) and noncancer hazard index (HI). ILCR and HI estimates are computed for each chemical in each medium, and are summed to yield a total ILCR and total HI for each receptor scenario. The PRA differs from an SRA in that no attempt is made to estimate an EPC that reflects a conservative estimate of average concentration for use in risk assessment. The 95 percent upper confidence limit on the mean (UCL) is usually used for this purpose. Instead, the MDC is adopted as the EPC, which imparts a conservative bias to the PRA.

The only plausible receptor scenario for the Forestry Compound is the National Guardsperson. COPCs for National Guardsperson exposure to surface soil include aluminum, arsenic, chromium and manganese (Table 1). The total ILCR of $1.12\text{E-}5$, due to nearly equal contributions from arsenic and chromium, falls within the EPA (1990) risk management range. The total HI of $2.55\text{E}+0$, due almost entirely to manganese, exceeds the threshold level of 1. It should be noted, however, that manganese is a ubiquitous metal whose concentration in soil varies over a wide range. Manganese was selected as a site-related chemical because its MDC ($3.69\text{E}+3$ mg/kg) exceeded its BSC ($1.58\text{E}+3$ mg/kg). However, the MDC did not exceed the UTL of $4.66\text{E}+3$ mg/kg. Furthermore, the MDC fell within the range of background for surface soil at Pelham Range (data not shown) (SAIC, 1998). It is deemed that manganese in surface soil is present at concentrations comparable to background, and that the HI for manganese should not be included in the total HI calculation for the National Guardsperson. The total HI without manganese ($1.41\text{E-}1$) falls below the threshold value of 1.

COPCs for the National Guardsperson for exposure to subsurface soil include aluminum, arsenic, chromium and manganese (Table 2). The total ILCR of $2.58\text{E-}5$ falls within the risk management range. The total HI of $1.32\text{E}+0$, due largely to manganese, slightly exceeds the threshold value of 1. Manganese was selected as a site-related chemical because its MDC ($1.80\text{E}+3$ mg/kg) exceeded its BSC ($1.36\text{E}+3$ mg/kg). However, the MDC did not exceed the UTL of $4.12\text{E}+3$ mg/kg. Furthermore, the MDC fell within the range of background for subsurface soil at Pelham Range (data not shown) (SAIC, 1998). It is deemed that manganese in subsurface soil is present at concentrations comparable to background, and that the HI for manganese should not be included in the total HI calculation for the National Guardsperson. The total HI without manganese ($1.48\text{E-}1$) falls below the threshold value of 1. It is concluded that National Guardsperson exposure to surface or subsurface soil at the Forestry Compound is unlikely to result in unacceptable cancer risk or adverse noncancer health effects.

The on-site resident was also evaluated as the upper-bound on exposure and risk and to provide additional perspective. COPCs selected for residential exposure to surface soil include several metals (Table 1). The total ILCR for exposure to surface soil of $4.60\text{E-}5$, due entirely to arsenic, is within the risk management range. The total HI for exposure to surface soil of $2.60\text{E}+0$, due to several metals, exceeds the threshold value of 1. Only manganese provides an HI greater than 1.

However, as explained above, manganese concentrations in surface soil probably represent background, and the HI for manganese should not be included in the total HI. Arsenic and chromium were also included in the HI total, but the MDCs of these metals fall below their respective UTLs and within the range of background for surface soil at Pelham Range (SAIC, 1998). Therefore, it is deemed that arsenic and chromium in surface soil represent background rather than site-related chemicals. The total HI without manganese, arsenic and chromium ($5.68E-1$) falls below the threshold value of 1.

COPCs for residential exposure to subsurface soil include aluminum, antimony, arsenic, chromium, iron, manganese and vanadium (Table 2). The total ILCR of $1.52E-4$, due entirely to arsenic, exceeds the EPA risk management range. The total HI of $6.15E+0$, due to several metals, exceeds the threshold value of 1. Manganese is deemed a background chemical in subsurface soil, as explained for the National Guardsperson evaluation, and should be removed from the total HI. The HI for iron should be removed for the same reason – its MDC falls below its UTL and within the range of background (data not shown) (SAIC, 1998). None of the remaining metals included in the total HI has an individual HI greater than 1, with the exception of arsenic. Furthermore, none of the remaining metals share a common target organ (please see toxicity profiles appended to IT [2000]); therefore, their individual HIs should not be summed. Arsenic in subsurface soil arises as the only risk driver at the Forestry Compound.

Arsenic is a plausible site-related chemical at the Forestry Compound because arsenicals are sometimes used as pesticides and herbicides, and they may have been stored, spilled or used on the site. Arsenic in subsurface soil exceeds its BSC and UTL at only two sample locations: HR-84-GP06 and HR-84-GP08 at depths of 10 to 12 feet below ground surface (Table 5-2). The greater concentration in subsurface soil than surface soil may reflect leaching. However, it is not plausible that a resident would be exposed to subsurface soil alone; excavation would result in exposure to a mix of surface and subsurface soil. A more reasonable evaluation, therefore, is performed by combining the data for surface and subsurface soil. The combined data set for arsenic was determined to be lognormally distributed (data not shown). The mean arsenic concentration was $1.72E+1$ mg/kg. A UCL of $2.30E+1$ mg/kg was estimated for arsenic using the protocol described by IT (1998). An ILCR for residential exposure to combined surface and subsurface soil of $5.40E-5$, within the EPA risk management range, is estimated when the UCL is used as the EPC for arsenic in the combined soil data set. An HI of $9.83E-1$, just below the threshold value of 1, is estimated using the UCL for arsenic. It is concluded that exposure to combined surface and subsurface soil at the Forestry Compound is unlikely to result in unacceptable cancer risk or adverse noncancer health effects for residential exposure or any standard receptor scenario. The site can be released for unrestricted use requiring no further action.

References

Goetchius, P.F., 2001, Memorandum to FTMC Risk Assessment File, subject: "National Guardsperson at Pelham Range," 11 October.

IT Corporation (IT), 1998, *Installation-Wide Work Plan*, Final, Fort McClellan, Calhoun County, Alabama, Prepared for U.S. Army Corps of Engineers, Mobile District, August*

IT Corporation (IT), 2000, ***Human Health and Ecological Screening Values and PAH Background Summary Report***, Final, Fort McClellan, Calhoun County, Alabama, Prepared for U.S. Army Corps of Engineers, Mobile District, August.

Science Applications International Corporation (SAIC), 1998, ***Final Background Metals Survey Report***, prepared for U.S. Army Corps of Engineers, Mobile District, July.

U.S. Environmental Protection Agency (EPA), 1990, "National Oil and Hazardous Substances Pollution Contingency Plan," ***Federal Register*** 55(46): 8666-8865.

U.S. Environmental Protection Agency (EPA), 2001, ***Region 4 Human Health Risk Assessment Bulletins – Supplement to RAGS, Interim Human Health Risk Assessment Bulletins***, Waste Management Division, EPA Region 4, Atlanta, GA, on line.

*Note: the Installation-Wide Work Plan was revised in September 2001 but has not yet been released for distribution. The description of the protocol and application of the SRA, however, was not substantively changed.

Table 1

**Preliminary Risk Evaluation for Exposure to Surface Soil
Forestry Compound - Pelham Range, Parcel 84(7)
Fort McClellan, Calhoun County, Alabama.**

(Page 1 of 2)

				Site- Related	Res Soil SSSL-c ^b	Res Soil SSSL-n ^c	Res Cancer	Res Noncancer	Res ILCR ^f	Res HI ^g	Res SSSL-c ^h	Res SSSL-n ⁱ	NG Cancer	NG Noncancer	NG ILCR ^j	NG HI ^k
Chemical	MDC	BSC	UTL	Chemical? ^a	SSSL-c ^b	SSSL-n ^c	COPC? ^d	COPC? ^e	ILCR ^f	HI ^g	SSSL-c ^h	SSSL-n ⁱ	COPC? ^d	COPC? ^e	ILCR ^j	HI ^k
METALS																
Aluminum	2.07E+04	1.63E+04	2.14E+04	2.07E+04		7.80E+03		2.07E+04		2.65E-01		1.47E+04		2.07E+04		1.41E-01
Antimony	5.67E+00	1.99E+00	2.64E+00	5.67E+00		3.11E+00		5.67E+00		1.82E-01		1.04E+02				
Arsenic	1.96E+01	1.37E+01	2.54E+01	1.96E+01	4.26E-01	2.34E+00	1.96E+01	1.96E+01	4.60E-05	8.38E-01	3.70E+00	7.96E+01	1.96E+01		5.30E-06	
Barium	1.92E+02	1.24E+02	1.94E+02	1.92E+02		5.47E+02						1.43E+03				
Beryllium	8.90E-01	8.00E-01	8.68E-01	8.90E-01		9.60E+00					3.42E+01	4.42E+01				
Cadmium	2.65E-01	2.90E-01	2.09E-01			6.25E+00					4.56E+01	1.08E+02				
Calcium	1.80E+05	1.72E+03	3.54E+03	1.80E+05												
Chromium	4.04E+01	3.70E+01	6.44E+01	4.04E+01		2.32E+01		4.04E+01		1.74E-01	6.85E+00	2.26E+02	4.04E+01		5.90E-06	
Cobalt	2.74E+01	1.52E+01	3.25E+01	2.74E+01		4.68E+02						6.30E+01				
Copper	6.30E+01	1.27E+01	2.25E+01	6.30E+01		3.13E+02						1.06E+04				
Iron	2.97E+04	3.42E+04	5.54E+04			2.34E+03						7.96E+04				
Lead	1.24E+02	4.01E+01	6.38E+01	1.24E+02		4.00E+02						8.80E+02				
Magnesium	9.74E+04	1.03E+03	9.60E+03	9.74E+04												
Manganese	3.69E+03	1.58E+03	4.66E+03	3.69E+03		3.63E+02		3.69E+03		1.02E+00		1.53E+02		3.69E+03		2.41E+00
Mercury	3.09E-01	8.00E-02	3.22E-01	3.09E-01		2.33E+00						7.12E+01				
Nickel	1.55E+01	1.03E+01	2.00E+01	1.55E+01		1.54E+02					3.42E+02	5.00E+03				
Potassium	6.92E+02	8.00E+02	6.01E+03													
Silver	6.34E-01	3.60E-01	1.13E+00	6.34E-01		3.91E+01						1.33E+03				
Sodium	8.29E+01	6.34E+02	5.63E+02													
Vanadium	6.47E+01	5.88E+01	9.94E+01	6.47E+01		5.31E+01		6.47E+01		1.22E-01		1.65E+03				
Zinc	8.08E+01	4.06E+01	7.37E+01	8.08E+01		2.34E+03						7.90E+04				
VOCs																
2-Butanone	4.00E-02			4.00E-02		4.66E+03						1.48E+05				
Acetone	4.50E-01			4.50E-01		7.76E+02						2.58E+04				
Methylene chloride	1.90E-03			1.90E-03	8.41E+01	4.66E+02					8.92E+02	1.55E+04				
Toluene	8.60E-04			8.60E-04		1.55E+03						4.98E+04				
Trichlorofluoromethane	1.80E-03			1.80E-03		2.33E+03						7.47E+04				
PESTICIDES																
4,4'-DDD	3.00E-03			3.00E-03	2.54E+00						2.64E+01					
4,4'-DDE	9.20E-04			9.20E-04	1.79E+00						1.87E+01					
4,4'-DDT	3.30E-03			3.30E-03	1.79E+00	3.83E+00					1.83E+01	1.22E+02				
Heptachlor	9.40E-04			9.40E-04	1.40E-01	3.88E+00					1.45E+00	1.29E+02				
Heptachlor epoxide	1.20E-03			1.20E-03	6.91E-02	1.01E-01					7.18E-01	3.35E+00				
Methoxychlor	7.30E-03			7.30E-03		3.89E+01						1.30E+03				
alpha-Chlordane	5.80E-04			5.80E-04	1.69E+00	3.79E+00					1.11E+02	1.70E+01				
Total ILCR, HI									4.60E-05	2.60E+00					1.12E-05	2.55E+00

Table 1

**Preliminary Risk Evaluation for Exposure to Surface Soil
Forestry Compound - Pelham Range, Parcel 84(7)
Fort McClellan, Calhoun County, Alabama.**

(Page 2 of 2)

All concentrations expressed as mg/kg.

MDC = maximum detected concentration; BSC = background screening criterion; UTL = 95% upper tolerance limit (incorporates data from Main Post and Pelham Range).

VOCs = volatile organic compounds.

^a MDC presented only if it exceeds BSC.

^b Site-specific screening level based on cancer risk for residential exposure to soil.

^c Site-specific screening level based on noncancer hazard for residential exposure to soil.

^d MDC presented only if it exceeds SSSL-c.

^e MDC presented only if it exceeds SSSL-n.

^f Incremental lifetime cancer risk for resident exposed to chemical in soil.

^g Hazard index for noncancer effects for resident exposed to chemical in soil.

^h Site-specific screening level based on cancer risk for National Guardsperson exposure to soil.

ⁱ Site-specific screening level based on noncancer hazard for National Guardsperson exposure to soil.

^j Incremental lifetime cancer risk for National Guardsperson exposed to chemical in soil.

^k Hazard index for noncancer effects for National Guardsperson exposed to chemical in soil.

Table 2

**Preliminary Risk Evaluation for Exposure to Subsurface Soil
Forestry Compound - Pelham Range, Parcel 84(7)
Fort McClellan, Calhoun County, Alabama**

				Site- Related	Res Soil	Res Soil	Res Cancer	Res Noncancer	Res	Res	NG Soil	NG Soil	NG Cancer	NG Noncancer	NG	NG
Chemical	MDC	BSC	UTL	Chemical? ^a	SSSL-c ^b	SSSL-n ^c	COPC? ^d	COPC? ^e	ILCR ^f	HI ^g	SSSL-c ^h	SSSL-n ⁱ	COPC? ^d	COPC? ^e	ILCR ^j	HI ^k
METALS																
Aluminum	2.18E+04	1.36E+04	1.80E+04	2.18E+04		7.80E+03		2.18E+04		2.79E-01		1.47E+04		2.18E+04		1.48E-01
Antimony	7.39E+00	1.99E+00	2.64E+00	7.39E+00		3.11E+00		7.39E+00		2.38E-01		1.04E+02				
Arsenic	6.48E+01	1.83E+01	3.24E+01	6.48E+01	4.26E-01	2.34E+00	6.48E+01	6.48E+01	1.52E-04	2.77E+00	3.70E+00	7.96E+01	6.48E+01		1.75E-05	
Barium	5.02E+01	2.34E+02	2.42E+02			5.47E+02						1.43E+03				
Beryllium	4.12E-01	8.60E-01	1.50E+00			9.60E+00					3.42E+01	4.42E+01				
Calcium	3.28E+03	6.37E+02	2.41E+03	3.28E+03												
Chromium	5.69E+01	3.83E+01	5.63E+01	5.69E+01		2.32E+01		5.69E+01		2.45E-01	6.85E+00	2.26E+02	5.69E+01		8.31E-06	
Cobalt	1.31E+01	1.75E+01	3.63E+01			4.68E+02						6.30E+01				
Copper	2.57E+01	1.94E+01	2.59E+01	2.57E+01		3.13E+02						1.06E+04				
Iron	4.55E+04	4.48E+04	5.63E+04	4.55E+04		2.34E+03		4.55E+04		1.94E+00		7.96E+04				
Lead	4.09E+01	3.85E+01	6.05E+01	4.09E+01		4.00E+02						8.80E+02				
Magnesium	1.74E+03	7.66E+02	5.54E+03	1.74E+03												
Manganese	1.80E+03	1.36E+03	4.12E+03	1.80E+03		3.63E+02		1.80E+03		4.96E-01		1.53E+02		1.80E+03		1.18E+00
Mercury	1.07E-01	7.00E-02	1.71E-01	1.07E-01		2.33E+00						7.12E+01				
Nickel	1.21E+01	1.29E+01	2.07E+01			1.54E+02					3.42E+02	5.00E+03				
Potassium	3.25E+02	7.11E+02	5.78E+03													
Sodium	4.64E+01	7.02E+02														
Thallium	9.89E-01	1.40E+00	6.62E+00													
Vanadium	9.41E+01	6.49E+01	9.05E+01	9.41E+01		5.31E+01		9.41E+01		1.77E-01		1.65E+03				
Zinc	5.34E+01	3.49E+01	7.13E+01	5.34E+01		2.34E+03						7.90E+04				
VOCs	0.00E+00															
Acetone	6.10E-02			6.10E-02		7.76E+02						2.58E+04				
Methylene chloride	1.60E-03			1.60E-03	8.41E+01	4.66E+02					8.92E+02	1.55E+04				
Total ILCR, HI									1.52E-04	6.15E+00					2.58E-05	1.32E+00

All concentrations expressed as mg/kg.

MDC = maximum detected concentration; BSC = background screening criterion; UTL = 95% upper tolerance limit (values for total soil; incorporates data from Main Post and Pelham Range).

VOCs = volatile organic compounds.

^a MDC presented only if it exceeds BSC.

^b Site-specific screening level based on cancer risk for residential exposure to soil.

^c Site-specific screening level based on noncancer hazard for residential exposure to soil.

^d MDC presented only if it exceeds SSSL-c.

^e MDC presented only if it exceeds SSSL-n.

^f Incremental lifetime cancer risk for resident exposed to chemical in soil.

^g Hazard index for noncancer effects for resident exposed to chemical in soil.

^h Site-specific screening level based on cancer risk for National Guardsperson exposure to soil.

ⁱ Site-specific screening level based on noncancer hazard for National Guardsperson exposure to soil.

^j Incremental lifetime cancer risk for National Guardsperson exposed to chemical in soil.

^k Hazard index for noncancer effects for National Guardsperson exposed to chemical in soil.